

1 CLAIMS

2 What is claimed is:

- 3 1. An image processing method comprising the steps of:  
4 dividing an inputted image into pixel groups, each of  
5 which has a specified size;  
6 calculating a pixel group density for each of the  
7 divided pixel groups; and  
8 calculating an output value of a certain watched pixel  
9 based on an absolute density of the watched pixel and a  
10 relative density for the watched pixel, the relative density  
11 being calculated based on the pixel group density of the  
12 pixel group, to which the watched pixel belongs, and the  
13 pixel group density of the pixel group adjacent to the pixel  
14 group, to which the watched pixel belongs, among the pixel  
15 groups in the image.
- 16 2. The image processing method according to claim 1,  
17 wherein the step of dividing an inputted image into the  
18 pixel groups is meshing the image into sub images, each of  
19 which has a rectangular area.
- 20 3. The image processing method according to claim 1,  
21 wherein the relative density is calculated by use of an  
22 influence degree calculated based on a distance from the  
23 watched pixel and the pixel group, to which the watched  
24 pixel belongs, to the pixel group adjacent to the pixel  
25 group, each of the adjacent pixel group being located on and  
26 under and at the right and left of the pixel group.

4. The image processing method according to claim 3,  
wherein in the step of calculating the pixel group den-  
sities, an average density of the divided pixel group is  
calculated, and

the relative density is obtained by multiplying the  
respective average densities of the pixel group, to which  
the watched pixel belongs, and of the pixel group adjacent  
to the pixel group, to which the watched pixel belongs, by  
the respective influence degrees.

5. The image processing method according to claim 1,  
wherein the relative density is calculated based on an  
influence degree obtained by a trapezoidal function repre-  
senting a positional relation between a coordinate position  
of the watched pixel and the pixel group adjacent to the  
pixel group, to which the watched pixel belongs.

6. The image processing method according to claim 1,  
wherein in the step of calculating an output value, the  
relative and absolute densities are weighted to calculate  
the output value.

7. A relative density detecting method for detecting a rela-  
tive density of a watched pixel constituting an inputted  
image, comprising the steps of:

dividing the image into pixel groups, each of which has  
a specified size;

detecting a pixel group density for each of the divided  
pixel groups;

extracting positional information for the watched pixel  
in a pixel group including the watched pixel; and

1 detecting a relative density of the watched pixel based  
2 on the pixel group density and the positional information.

3 8. An image processing apparatus comprising:

4 pixel group dividing means for dividing an inputted  
5 image into pixel groups, each of which has a specified size;

6 pixel group density detecting means for detecting a  
7 pixel group density for each of the pixel groups divided by  
8 the pixel group dividing means;

9 weight deciding means for deciding each weight of the  
10 pixel groups adjacent to the pixel, to which a watched pixel  
11 belongs, based on a position of the watched pixel to be  
12 outputted;

13 watched pixel density detecting means for detecting a  
14 density of the watched pixel; and

15 relative density calculating means for calculating a  
16 relative density of the watched pixel based on a detected  
17 density of the watched pixel, a pixel group density of the  
18 detected pixel group and a decided weight of the pixel  
19 group.

20 9. The image processing apparatus according to claim 8, fur-  
21 ther comprising:

22 output density calculation means for calculating an  
23 output density by weighting the density of the watched pixel  
24 detected by the watched pixel density detecting means and  
25 the relative density calculated by the relative density cal-  
26 culating means.

27 10. The image processing apparatus according to claim 8,

1        wherein the pixel group dividing means roundly divides  
2        an inputted image into meshes, each of which has I pixels×J  
3        pixels (I, J: integers).

4        11. The image processing apparatus according to claim 8,  
5        wherein the weight deciding means comprises a table  
6        look-up for deciding weights of pixel groups adjacent to a  
7        pixel group, to which the watched pixel belongs, based on a  
8        coordinate position of the watched pixel, the pixel groups  
9        being located at the right and left of the pixel group, to  
10       which the watched pixel belongs, and/or on and under the  
11       pixel group, to which the watched pixel belongs.

12       12. The image processing apparatus according to claim 8,  
13       wherein the weight deciding means adds weights of pixel  
14       groups adjacent to a pixel group, to which the watched pixel  
15       belongs, to obtain a sum of 1, the pixel groups being  
16       located at the right and left of the pixel group, to which  
17       the watched pixel belongs, and/or adds weights of pixel  
18       groups adjacent to a pixel group, to which the watched pixel  
19       belongs, to obtain a sum of 1, the pixel groups being  
20       located on and under the pixel group, to which the watched  
21       pixel belongs.

22       13. An image processing apparatus for converting image data,  
23       which includes a specified object photographed by a digital  
24       camera, into a binarized image, comprising:  
25       a meshing unit for meshing the entire image data into  
26       sub images;

1 an average density detection unit for detecting an  
2 average density of each of the sub images meshed by the  
3 meshing unit; and

4 a density detection unit for detecting a density of a  
5 pixel constituting the object,

6 wherein a binarized image, in which an outline of the  
7 object is emphasized, is generated based on a detected den-  
8 sity of the pixel, an average density of the sub image, to  
9 which the pixel belongs, and an average density of the sub  
10 image adjacent to the certain sub image.

11 14. An article of manufacture comprising a computer usable  
12 medium having computer readable program code means embodied  
13 therein for causing image processing, the computer readable  
14 program code means in said article of manufacture comprising  
15 computer readable program code means for causing a computer  
16 to effect the steps of claim 1.

17 15. An article of manufacture comprising a computer usable  
18 medium having computer readable program code means embodied  
19 therein for causing relative density detection, the computer  
20 readable program code means in said article of manufacture  
21 comprising computer readable program code means for causing a  
22 computer to effect the steps of claim 7.

23 16. A program storage device readable by machine, tangibly  
24 embodying a program of instructions executable by the machine  
25 to perform method steps for causing image processing, said  
26 method steps comprising the steps of claim 1.

